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# GOSAT Measurements of $CO_2$ and $CH_4$ Columns: Impact of Reduced Spectral Resolution on Retrieval Accuracy

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The Carbon Monitoring Satellite (CarbonSat) is one of two candidate Earth Explorer Opportunity Missions, scheduled for launch in 2018. Its goal is to monitor tropospheric $CO_2$ and $CH_4$ by measuring reflected Sun light in the infrared (four separate observation windows between 0.7 and 2.0 $\mu$m). Since the Fourier-transform spectrometer on board the Japanese GOSAT satellite observes at a very similar range as the planned CarbonSat spectrometer, GOSAT spectra offer an excellent opportunity to study the impact of instrument settings on retrieval accuracy. The main topic of this study is the impact of spectral resolution on retrieval accuracy of $CO_2$ and $CH_4$, i.e., does a lowered resolution make spectroscopic errors more obvious? This question is relevant for the CarbonSat mission because the instrument line shape will probably be about five times broader than for GOSAT, but it is also of general interest for the remote sensing of $CO_2$ and $CH_4$. Two different approaches are used to reduce the spectral resolution of the native GOSAT spectra. The columns of $CO_2$ and $CH_4$ that are retrieved from the spectra are then compared to collocated observations from six different observation sites of the Total Carbon Column Observing Network (TCCON).

The two instrument settings with a similar spectral resolution but different degradation approach give a similar increase in scatter and decrease of correlation. For the $CO_2$ retrieval accuracy, the only notable effect of lowering the spectral resolution from GOSAT to CarbonSat resolution is the increase of the standard deviation of retrieval errors from 0.7% to 1.0%. Other quality criteria (convergence, inter-stational bias) do not change. For $CH_4$ columns, the standard deviation hardly increases (from 0.9% to 1.0%). Reducing the spectral resolution does not further increase the strength nor the significance of retrieval biases with respect to water abundance, albedo, or solar zenith angle. The selective degradation of single windows demonstrates that the retrieval accuracy of $CO_2$ and $CH_4$ is dominated by the spectral range where the absorption bands of the target molecule are situated.